3GPP TSG RAN Meeting #71
Göteborg, Sweden, March 7 - 10, 2016

RP-160623

Source:	**Samsung**
Title:	**New WID Proposal: Enhancements on Full-Dimension (FD) MIMO for LTE**
Document for:	**Approval**
Agenda Item:	**10.1.1**

3GPP™ Work Item Description

For guidance, see 3GPP Working Procedures, article 39; and 3GPP TR 21.900.
Comprehensive instructions can be found at http://www.3gpp.org/Work-Items

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Title: Enhancements on Full-Dimension (FD) MIMO for LTE

Acronym: LTE_eFDMIMO

Unique identifier:

NOTE: If this is a RAN WID including Core and Perf. Part, then Title, Acronym and Unique identifier refer to the feature WI. Please tick (X) the applicable box(es) in the table below:

This WID includes a Core part	**X**
This WID includes a Performance part	**X**

1 3GPP Work Area

X	**Radio Access**
	Core Network
	Services

2 Classification of WI and linked work items

2.0 Primary classification

This work item is a …

	Study Item (go to 2.1)
X	**Feature (go to 2.2)**
	Building Block (go to 2.3)
	Work Task (go to 2.4)

NOTE: Core, Performance and Testing parts of RAN Wis are usually Building Blocks.
If you are in doubt, please contact MCC.

2.1 Study Item

Related Work Item(s) (if any)		
Unique ID	**Title**	**Nature of relationship**

Go to §3.

2.2 Feature

Related Study Item or Feature (if any)		
Unique ID	**Title**	**Nature of relationship**
650015	Study on Elevation Beamforming/Full-Dimension (FD) MIMO for LTE	Corresponding SI

Go to §3.

2.3 Building Block

Parent Feature (or Study Item)		
Unique ID	**Title**	**TS**

This work item is …

	Stage 1 (go to 2.3.1)
	Stage 2 (go to 2.3.2)
	Stage 3 (go to 2.3.3)
	Test spec (go to 2.3.4)
	Other (go to 2.3.5)

2.3.1 Stage 1

Source of external requirements (if any)		
Organization	**Document**	**Remarks**

Go to §3.

2.3.2 Stage 2

Corresponding stage 1 work item		
Unique ID	**Title**	**TS**

Other source of stage 1 information		
TS or CR(s)	**Clause**	**Remarks**

If no identified source of stage 1 information, justify:

Go to §3.

2.3.3 Stage 3

Corresponding stage 2 work item (if any)		
Unique ID	**Title**	**TS**

Else, corresponding stage 1 work item		
Unique ID	**Title**	**TS**

Other justification		
TS or CR(s) or external document	**Clause**	**Remarks**

If no identified source of stage 2 information, justify:

Go to §3.

2.3.4 Test spec

Related Work Item(s)		
Unique ID	**Title**	**TS**

Go to §3.

2.3.5 Other

Related Work Item(s)			
Unique ID	**Title**	**Nature of relationship**	**TS / TR**

Go to §3.

2.4 Work task

Parent Building Block		
Unique ID	**Title**	**TS**

3 Justification

With the recent advances in active antenna (AA) array technology, utilizing a large number of antenna elements at eNB for boosting cell capacity and coverage has become feasible and justified in terms economies of scale. As antenna cables connecting RF/front-end units and antennas can be avoided, the cost of deploying such eNBs is significantly reduced. MIMO transmissions utilizing such technology can provide significant capacity improvement as observed during the study on performance and feasibility of EB/FD-MIMO (TR 36.897).

Based on the conclusions of the EB/FD-MIMO study item, 3GPP developed specification support for EB/FD-MIMO in Rel-13 by enhancing the relevant reference signals and CSI reporting mechanism. Although EB/FD-MIMO is supported as part of Rel-13, only parts of the proposals resulting from the study have been specified. Firstly, only up to 16 antenna ports are supported and therefore the benefit from an antenna array with more than 16 TXRUs is limited. Secondly, there is no enhancement on CSI reports to enable efficient MU spatial multiplexing. Lastly, there is no support for providing higher robustness against CSI impairments (such as inter-cell interference or higher-speed UEs) and higher CSI accuracy. eFD-MIMO WI for Rel-14 is proposed to address these Rel-13 limitations.

4 Objective

4.1 Objective of SI or Core part WI or Testing part WI

The work item aims to specify the enhancements identified for utilizing both elevation and azimuth domains with 1D and 2D port layouts with cross-poles at eNBs. The detailed objectives are as follows.

- Specify enhancements on reference signal in the following areas [RAN1]
    - Non-precoded CSI-RS, extending the existing numbers {1, 2, 4, 8, 12, 16} of CSI-RS antenna ports for support of {20, 24, 28, 32} CSI-RS ports with mechanism for reducing the overhead for CSI-RS transmission
    - Beamformed CSI-RS, supporting CSI-RS resource utilization with improved efficiency for UE-specific beamformed CSI-RS including specifying support for aperiodic CSI-RS
    - Evaluate and, if needed, specify enhancement on ~~U~~uplink DMRS~~ enhancement,~~ to support (more than 2) orthogonal DMRS for MU-MIMO with partially overlapping BWs allocation
- Extend specification support for CSI reporting in the following areas [RAN1]
    - Codebook(s) associated with the newly supported number of non-precoded CSI-RS ports for a subset of possible port layouts, both 1D and 2D
        - ~~RAN1 will select the subset of port layouts to be specified~~

    ~~•~~ CSI reporting mechanism to support joint utilization of different CSI-RS types at the UE such as between non-precoded CSI-RS and beamformed CSI-RS as well as between different types of beamformed CSI-RS

    - As second priority, ~~E~~evaluate and, if needed, specify enhancement on CSI reporting ~~for higher resolution CSI feedback for~~ based on non-precoded and beamformed CSI-RS to improve eNB precoding (such as new feedback methodologies in addition to codebook-based CSI feedback) and interference measurement to support efficient multi-user transmissions (e.g. further enabling interference estimation from NZP or ZP CSI-RS)
        - Analog feedback is not precluded
- Evaluate and, if needed, specify enhancement to support DMRS-based open-loop transmission with the existing numbers of CSI-RS ports as well as the newly supported number of CSI-RS ports, in the following areas [RAN1]
    - Necessary CSI reporting scheme, including with and without PMI; and/or
    - Necessary open-loop transmission scheme
- Specify higher layer support of enhancements listed above [RAN2]
- ~~Specify the necessary AAS BS core requirements [RAN4] (Note: RAN#71 meeting will discuss whether the following objectives will stay in this WI or will be moved to the generic RAN4 AAS WI)~~

~~- Specify OTA requirements for in band unwanted emissions such that all such emissions are captured and can be measured without connectors~~

~~- Investigate the applicability of current signal quality requirements and specify either EVM or another suitable metric(s) OTA in order to properly capture signal quality without the need for connectors~~

~~- Specify the OTA RX requirements, except RX spurious emissions and out of band blocking, such that FD-MIMO base stations have flexibility to implement flexible and balanced receivers that are subject to system requirements~~

- ~~Investigate the need for conducted power and power dynamics requirements and if needed and possible specify OTA~~
- ~~Investigate the possibilities for non-connector based measurement of TX and RX spurious emissions and RX out of band blocking and if possible specify OTA~~
- ~~BS classification may need to be revisited due to minimum OTA coupling loss~~
- eNB core requirements for eFD-MIMO will be specified in the RAN4 AAS WI [Enh_AAS_BS_LTE_UTRA_core].

Impact on UE and eNB complexity should be taken into account.

4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

Specify the necessary UE performance requirements to utilize both elevation and azimuth domains with 2D antenna array at eNBs.

Specify AAS BS conformance tests to verify AAS BS core requirements.

4.3 RAN time budget proposal

NOTE: For Wis/Sis under RAN WG5 leadership this section is not filled out. Otherwise:
For a not yet approved WI/SI the rapporteur has to fill out the last row of the table(s) below up to the target date of the WI/SI (if necessary add further tables): Indicate the number of time units (1 TU ~ 2h), i.e. one value for each session/field. If no time unit is needed, leave the field empty.
Once the WI/SI is approved, the tables below will no longer be updated in the WI/SI description (i.e. the tables reflect the status of the initial approval). But changes can be proposed in the status report of the WI/SI.

RAN #71										**Q2/2016**									**RAN #72**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf	R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
84bis	84bis	93bis	93bis	93bis	91bis	78bis	78bis	78bis	78bis	85	85	94	94	94	92	79	79	79	79
3~~4~~						~~1.5~~				3~~4~~						~~1.5~~			

RAN #72					**Q3/2016**				**RAN #73**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
86	86	95	95	95	93	80	80	80	80
3~~5~~						~~1.5~~			

RAN #73										**Q4/2016**									**RAN #74**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf	R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
86bis	86bis	95bis	95bis	95bis	93bis	80bis	80bis	80bis	80bis	87	87	96	96	96	94	81	81	81	81
~~5~~4						~~1.5~~				~~5~~4		**0.5**				~~1.5~~			

RAN #74					**Q1/2017**				**RAN #75**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf

88	88	97	97	97	95	82	82	82	82
4		**1**				~~1.5~~			

RAN #75 Q2/2017 RAN #76																			
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf	R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
88bis	88bis	97bis	97bis	97bis	95bis	82bis	82bis	82bis	82bis	89	89	98	98	98	96	83	83	83	83
								~~1.5~~	**2**									~~1.5~~	**2**

RAN #76 Q3/2017 RAN #77									
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
90	90	99	99	99	97	84	84	84	84
								~~1.5~~	**2**

L: LTE, U: UMTS, J: Joint, RD: RRM/demodulation

NOTE: In case further explanation of the time budget proposal is needed, then please explain this below.

Additional comments to the time budget proposal:

5 Service Aspects

6 MMI-Aspects

7 Charging Aspects

8 Security Aspects

9 Impacts

Affects:	**UICC apps**	**ME**	**AN**	**CN**	**Others**
Yes		X	X		
No	X			X	X
Don't know					

10 Expected Output and Time scale

New specifications [If Study Item, one TR is anticipated]						
Spec No.	Title	1st rsp. WG	2nd rsp. WG(s)	Presented for information at plenary#	Approved at plenary #	Comments

NOTE: If this is a RAN WID including Core and Perf. Part, then all new Core part specs have to be listed first and then all new Perf. Part specs. Indicate "Core part" or "Perf. Part" under Comments for each spec.
By default a new specs can only be new for one of both parts.

Affected existing specifications [None in the case of Study Items]				
Spec No.	CR	Subject of the CR	Approved at plenary#	Comments
36.211		Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation	RAN#75	Core Part
36.212		Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding	RAN#75	Core Part
36.213		Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures	RAN#75	Core Part
36.214		Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements	RAN#75	Core Part
36.300		Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2	RAN#75	Core Part
36.306		Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities	RAN#75	Core Part
36.331		Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification	RAN#75	Core Part
36.101		Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception	RAN#75	Core Part
36.101		Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception	RAN#77	Performance Part

NOTE: If this is a RAN WID including Core and Perf. Part, then all new Core part specs have to be listed first and then all new Perf. Part specs. Indicate “Core part” or “Perf. Part” under Comments for each spec.
If an existing spec is affected by both (Core part and Perf. Part), then it has to be listed twice with appropriate approval dates.

11 Work item rapporteur(s)

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12 Work item leadership

RAN WG1

NOTE: If this is a RAN WID including Core and Perf. Part, then this WG specifies the WG leading the Core part.
RAN WG4 is by default leading the Perf. Part.

13 Supporting Individual Members

Supporting IM name
Samsung
Nokia Networks
CATT
Alcatel-Lucent
Alcatel-Lucent Shanghai Bell
China Telecom
AT&T
Beijing Xinwei Telecom Tech.
CATR
China Unicom
CHTTL
CMCC
Ericsson
ETRI
HiSilicon
HTC
Huawei
III
InterDigital
Intel
ITL
ITRI
KDDI
KT
LG Electronics
LG Uplus
MediaTek
Mitsubishi Electric
NEC
NTT DOCOMO
OPPO
Orange
Potevio
SKT
Sony
Spreadtrum
Straight Path
Telecom Italia
Verizon
ZTE